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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/584,796	06/01/2000	Fredrik Lindqvist	1410-679	4990

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EXAMINER	
JAMAL, ALEXANDER	
ART UNIT	**PAPER NUMBER**
2643	

DATE MAILED: 08/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/584,796	LINDQVIST ET AL.	
	Examiner	Art Unit	
	Alexander Jamal	2643	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 June 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-44* is/are pending in the application.

4a) Of the above claim(s) *2,8 and 29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-7,9-28,30-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment (6-14-2005)

1. Examiner notes that claim 29 has been cancelled.

2. Examiner withdraws the 35 USC 112 rejection to claim 29.

3. Examiner maintains the current set of rejections and presents responses to applicant's arguments.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1,3-7,9-17,20-43,** rejected under 35 U.S.C. 103(a) as being unpatentable over Ho et al. (5317596), and further in view of Dowling (6597745).

As per **claim 1,** Ho discloses an echo canceller used in a transceiver (ABSTRACT). The device comprises electronic circuitry configured to estimate and remove echo signals in the frequency domain (Fig. 3 Col 5 line 65 to Col 6 line 22). However, Ho does not disclose that the echo signals are estimated with a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol.

Dowling teaches an adaptive precoder that enables a block oriented receiver to recover a datastream in the presence of ISI and noise (ABSTRACT) that will reduce computational complexity over previous implementations (Col 2 lines 40-55). He further suggests that the precoder may be implemented in (merged with) an echo canceller (Col 22 lines 1-17). The precoder detects and compensates for noise (and ISI) in the signal using a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol (Fig. 5 Col 17 lines23-65). It would have been obvious to one of ordinary skill in the art at the time of this application to implement the precoder's functionality with Ho's echo canceller to produce an echo signal (in the frequency domain) for the advantage that the precoder (and as such, the echo canceller) takes into account ISI and ICI (noise) and provides reduced computational complexity.

As per **claims 12,24,37,38,** claims rejected for same reasons as claim 1. Additionally, Dowling discloses that the input signal vector may be multiplied with a column vector (Col 9 lines 15-55).

As per **claims 20,30,35,** claims rejected for same reasons as rejection of claim 1. Additionally, Dowling discloses that the precoder takes into account the effects of ICI (Col 8 lines 60-67).

As per **claims 3,13,26,32,43,** Dowling discloses that the input vector (and as such, the delayed vector) is hermitian-symmetric and is divided into real and imaginary parts (the imaginary parts are ignored) before matrix processing (Col 9 line 15 to Col 10 line 5).

As per **claims 4,5,22,31,** the first matrix (DOWLING: Figs 3,5) has coefficients that represent how an echo from a currently transmitted signal affects a received signal, and the second Matrix (DOWLING: Figs 4,5) represents how an echo from a previously transmitted signal affects the received signal.

As per **claims 6,7,34,36,** Ho discloses that the circuitry adapts the echo canceller coefficients (coefficients of the matrices) using a difference between the receive signal and the echo estimate signal using an lms algorithm (device 58, Fig. 3, Col 6 lines 50-62).

As per **claim 9,** Dowling discloses that the device may be implemented in a DMT transceiver (ABSTRACT).

As per **claim 10,** Dowling discloses that the Matrices may be NxN matrices (Col 7 lines 30-50).

As per **claims 11,33,42,** Dowling discloses that the device will function for a vector communication signal (which inherently includes, by definition, the transmit, receive, and echo estimate signals) such as a DMT system with Hermitian symmetric signal points (Col 2 lines 58-67).

As per **claims 14,15,23,** Dowling discloses a compensation (twiddle) factor (applied to both matrices) to compensate the previously transmitted signal that is a complex exponential term (Col 11 line 53 to Col 12 line 25, Col 14 lines 5-15). The

twiddle factor is also applied to the triangular submatrix formed to compensate for a cyclic prefix (Col 20 lines 49-60). Dowling also discloses the device is used in a DMT type transceiver (ABSTRACT).

As per **claims 16, 17,27,28,40,41,** Ho discloses that for applications involving asymmetric data, the signal should be decimated or interpolated as appropriate (Col 7 lines 49-62).

As per **claim 21,** claim rejected for same reasons as rejections of claims 1 and 9.

As per **claim 25,39,** the matrix is combined with a difference between the current transmit signal and the product of the delayed signal (previously transmitted) and the compensating factor in the matrix (as per rejection of claim 14) (DOWLING: Fig. 5).

6. **Claims 18,19** rejected under 35 U.S.C. 103(a) as being unpatentable over Chaffee et al. (5117418), and further in view of Dowling (6597745).

As per **claim 18,** Chaffee discloses an echo canceller used in a transceiver (ABSTRACT). The device comprises electronic circuitry configured to estimate echo signals in the frequency domain, convert the estimate to the time-domain, then subtract the estimate in the time domain (Col 3 line 5 to Col 4 line 10). However, Chaffee does not disclose that the echo signals are estimated with a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol.

Dowling teaches an adaptive precoder that enables a block oriented receiver to recover a datastream in the presence of ISI and noise (ABSTRACT) that will reduce computational complexity over previous implementations (Col 2 lines 40-55). He further suggests that the precoder may be implemented in (merged with) an echo canceller (Col 22 lines 1-17). The precoder detects and compensates for noise (and ISI) in the signal using a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol (Fig. 5 Col 17 lines23-65). It would have been obvious to one of ordinary skill in the art at the time of this application to implement the precoder's functionality with Chaffee's echo canceller to produce an echo signal (in the frequency domain) for the advantage that the precoder (and as such, the echo canceller) takes into account ISI and ICI (noise) and provides reduced computational complexity.

As per **claim 19,** claim rejected for same reasons as rejection of claim 18. Additionally, Dowling discloses that the input signal vector may be multiplied with a vector (Col 9 lines 31-55).

7. **Claim 44** rejected under 35 U.S.C. 103(a) as being unpatentable over Chaffee et al. (5117418) as applied to claim 35, and further in view of Dowling (6597745).

As per **claim 44,** Chaffee discloses an echo canceller used in a transceiver (method of reducing an echo) (ABSTRACT). The device comprises electronic circuitry configured to estimate echo signals in the frequency domain, convert the estimate to the

time-domain, then subtract the estimate in the time domain (Col 3 line 5 to Col 4 line 10). However, Chaffee does not disclose that the echo signals are estimated with a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol.

Dowling teaches an adaptive precoder that enables a block oriented receiver to recover a datastream in the presence of ISI and noise (ABSTRACT) that will reduce computational complexity over previous implementations (Col 2 lines 40-55). He further suggests that the precoder may be implemented in (merged with) an echo canceller (Col 22 lines 1-17). The precoder detects and compensates for noise (and ISI) in the signal using a combination of both a product of a first matrix and transmitted symbol and a product of a second matrix and a previously transmitted symbol (Fig. 5 Col 17 lines23-65). It would have been obvious to one of ordinary skill in the art at the time of this application to implement the precoder's functionality with Chaffee's echo canceller to produce an echo signal (in the frequency domain) for the advantage that the precoder (and as such, the echo canceller) takes into account ISI and ICI (noise) and provides reduced computational complexity.

Response to Arguments

8. Applicant's arguments filed 6-14-2005 have been fully considered but they are not persuasive.

As per applicant's argument that Ho does not disclose a frequency domain echo canceller (remarks page 10), examiner notes that Ho Fig. 3 discloses an echo canceller

that estimates/cancels echoes in the frequency domain and further discloses Fig. 4 where again echoes are estimated and removed in the frequency domain (Col 6 lines 1-50). Examiner further notes that if applicant reads Fig. 3 of HO as a time domain echo canceller then Fig. 3 of Ho could be used in combination with Dowling to reject claims 18,19 and 44 (which are currently rejected with Chaffee in view of Dowling).

As per applicant's argument that Dowling does not remedy Ho's deficiency and that the Ho and Dowling combination fails logically and technically (remarks pages 11-13), examiner disagrees. Examiner notes that the use of near end and far end systems by applicant is arbitrary as the precoder and echo canceller could obviously be implemented at **both** ends of a communication system with the outgoing transmit signal being precoded and the incoming received signal being echo cancelled. For the sake of argument, examiner will explain the combination of Ho and Dowling in a 'near-end' situation. When Dowling's precoder is implemented (at the near-end) the signals that are transmitted out on the line will be the pre-coded signals. As such, in order for a near-end echo canceller to function correctly, it must analyze the outgoing signal and create an echo estimate from that signal. Since the signal is a precoded signal, the precoded signal must be fed into the echo canceller so that the echo canceller can correctly estimate the echo that is going to be reflected back and potentially interfere with the received signal. As such the echo estimate is created by 'using' (as per applicant's claim 1 language) a precoded signal, which is a combination of matrix coefficients of currently and previously transmitted signals. The Dowling reference clearly anticipates this combination when he states that an echo canceller may be **'merged'** with the precoder (as

referenced in the previous office action). Examiner requests applicant to offer an explanation as to how the precoder and echo canceller would be merged (as per the disclosed prior art) and not function correctly in view of the fact that a precoder and echo canceller may be implemented at a near-end or a far-end. Examiner notes that the precoding is used to mitigate interference between waveforms (carriers and symbols) within the outgoing signal, while the echo canceller is only concerned with estimating the echo of any signal that is being transmitted on the transmission line. They are being used for two different functions that may simultaneously be combined and implemented as specified in the Dowling reference. However, the echo canceller must take into account the precoded signal in order to effectively cancel the outgoing waveform echo (which is based off of the precoded output signal).

As per applicant's arguments that Ho and Dowling do not compensate for echo ICI and ISI (remarks page 14), examiner disagrees. As mentioned above, the echo canceller is only concerned with the entire signal being transmitted, while the precoding is used to make the outgoing signal resistant to the effects of waveforms within the signal interfering with each other (ICI, ISI). If the signal input into the echo canceller has been precoded (as per the argument above) then the echo estimate **will** take into account ICI and ISI because the canceller will adapt the precoded signal to create the echo estimate. Since the precoded signal also takes the ICI and ISI into account, the estimate (based off the precoded signal) will also take the ICI and ISI into account. Examiner further notes that inter-carrier-interference and inter-symbol-interference are both terms used to describe waveforms within a transmitted signal that interfere with one another due to

imperfections in the transmission medium. Examiner contends that Dowling's precoder **would** mitigate both forms of 'noise'. Additionally, Dowling **does** indicate that the precoding will work for ICI (Dowling Col 8 lines 55-65) or the 'block' distortions (which would include a carrier wave, a 'subchannel within a channel'). Examiner further notes applicant's specification page 3 lines 5-20 which disclose that inter-channel-interference refers to the carrier waveforms (or subchannels) within the signal.

As per applicant's arguments that the examiner has not made clear how the Chaffee and Dowling references would be combined (remarks pages 14-15), examiner offers the above comments as a guideline to applicant as to how the combination would work. The Chaffee reference would take the precoded signal, transform it into the time domain and then proceed with the echo canceller function. Examiner notes the well known FFT and IFFT functions in Figs. 1 and 2 of Chaffee. Furthermore examiner notes that if applicant reads Ho Fig. 3 as a time domain echo canceller, then that could also be used in combination with Dowling to reject applicant's claims 18,19,44.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander Jamal whose telephone number is 571-272-7498. The examiner can normally be reached on M-F 9AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Curtis A Kuntz can be reached on 571-272-7499. The fax phone numbers for the organization where this application or proceeding is assigned are **571-273-8300** for regular communications and **571-273-8300** for After Final communications.

AJ
August 3, 2005

CURTIS KUNTZ
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